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ABSTRACT

This paper describes Horizon, a European-funded project designed to increase employment opportunities for students with disabilities or learning difficulties. The project established a working cafe/restaurant (Cafe Horizon) in East London staffed by students. Part of the project involved the creation of multimedia units linked directly to Level 1 National Vocational Qualifications (NVQ) in Catering and Business Studies to support the training of the cafe workers. Cafe workers attend a college one day each week where they use multimedia materials to work toward their NVQ in Catering. One challenge of the project was to produce learning materials that could be configured for the individual learning problems of different cafe workers. To this end, a measure of differentiation was achieved in some learning units based on language level of the learner and subject level of the delivery. Learners worked individually or in small groups with specialist support workers who assisted users and participated in evaluation of the software. This paper describes how tasks are used within some of the multimedia applications to provide differential challenges for Cafe Horizon workers. The report also addresses the underlying pedagogy and use of task-based materials and the design of multimedia materials. (Contains 14 references.) (CR)

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The creation of task-based differentiated learning materials for students with learning difficulties and/or disabilities.

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Abstract:

Horizon is a European funded project whose aim is to increase employment opportunities for students with disabilities or learning difficulties. A working cafe / restaurant (Cafe Horizon) has been established in East London, staffed by students involved in this project. Part of the project involved the creation of multimedia units, linked directly to Level 1 NVQ Catering and Business Studies, to support the training of the Cafe Horizon workers. One challenge of this work was to produce learning material that could be configured for the cafe worker in respect of their particular individual learning problems. To this end, a measure of differentiation was achieved in some learning units based on language level of the learner and subject level of the delivery. This paper describes the ways in which tasks are used within some of the multimedia applications to provide differential challenges for Cafe Horizon workers. Future work is planned where the individual learning style of the Cafe Horizon workers is considered.

1 Introduction

The aim of the Horizon project is to increase employment opportunities for students with disabilities or learning difficulties by providing appropriate training and work experience based in Cafe Horizon. Cafe Horizon workers attend Waltham Forest College one day each week where they work towards their NVQ in Catering. The Horizon multimedia materials form the basis of this work. Learners work individually or in small groups with specialist support workers who assist users and also participate in a situated evaluation of the software. Horizon learners are fully integrated with other learners in College open access IT centres using standard multimedia computers that have been slightly modified, for example, with touch screens. Other groups pilot the software at Waltham Forest Disability Resource Centre and at Hereford and Worcester Training Enterprise Council (HAWTEC). The installation, maintenance and evaluation of software at all locations is

centrally co-ordinated by Waltham Forest College.

Students with learning difficulties and disabilities constitute a wide range of students who require varying additional support in their learning. Some students on the Cafe Horizon project have severe physical disability, yet in all other ways cannot be distinguished from other learners. Other Cafe Horizon workers have emotional and cognitive problems that impose severe restrictions on learning. Some have a combination of physical and mental disability in addition to problems of language.

All learners follow the same core course material, related to NVQ Level 1 Catering and Business Studies. It is important that this material is interesting and challenging to all learners and that all users derive some benefit from its use. An underlying theme in the production of multimedia support for these courses is therefore the need to create material which is individually configurable for the learner.

2 Differentiation and configuration of learning materials

The differential presentation of learning materials and configuration of such materials to the needs of different users has been considered by a number of authors. For example, Riding has looked at the presentation of learning for learners with differing learning styles (see, for example, Riding 1996). Others have also related performance on learning applications to performance of learning style tests (Freeman 1996). Issues as to the configuration of learning applications have been approached in several different ways. Lanzing, for example, looked at preferred learning styles in relation to text or image based presentations (Lanzing 1994) and suggested three alternative approaches to tailoring presentations to a learner's individual needs:

* provide support for text and visual presentation modes, making learning as easy as possible for all learners;
* use the single mode that best fits the learner's individual situation;
* use only one mode, and not necessarily the mode that supports the learner best, arguing that this would reduce stimulation to the learner.

In the Horizon project, it was decided to attempt a combination of these three approaches in order to support a wide range of learners. Examples of the way in which multimedia Horizon materials could be configured are given in section 4.

3 Underlying pedagogy - use of task-based materials

In the early days, behaviourist theories of learning were applied in the design of computer based instruction. In more recent times, authors have been keen to apply cognitive theories of learning to the design of such applications. The justification for this change relates to a paradigm shift in our understanding of learning that took place in the late 1960s and 1970s. Patrick (1992) has summarised many of the developments that have led to many of these changes.

Cognitive theories are concerned with the underlying thought processes that take place when people learn (Atkins 1993). According to cognitive theories, learners are expected to build their own hypotheses and explanations based on their learning experiences. Participation in active learning tasks is seen to be important in developing such constructs.

Tasks provide a means of engaging student's attention, and users of computer-based instruction packages are therefore commonly required to interact with the material. Frequent decision points are important as are games and simulations in which the results of decisions can be immediately seen (Atkins 1993). It has been suggested that the task of building computer models may provide direct support for the construction of mental models (Wild 1996), and Khan and Yip see tasks involving free exploration and self-directed learning as important for the testing of such models. Khan and Yip suggest that for maximum effectiveness, task-centred instruction should be situated in tasks where knowledge is normally applied (Khan and Yip 1996).

The use of tasks to develop higher level cognitive skills in learning has been considered in the classroom by Felder and Brent (Felder et al 1994). Passive learning and an algorithmic approach to problem solving were cited as the among the reasons for high drop-out rates in science courses. In-class exercises investigated as an alternative approach included recall, stage setting and problem solving, and provide inspiration for the development of tasks for incorporation in multimedia learning packages.

4 Design of multimedia materials

Material for the Horizon project has been developed with all of the above points in mind. The aim has been to provide multimedia learning materials which support task-based learning at a range of different levels and using a variety of presentation modes so that the system can be configured to meet the individual needs of students with learning difficulties or disabilities.

Material is produced by teams of domain experts and educationalists, special support workers and technical experts. The detailed process used to design multimedia material for the Horizon project is described elsewhere (Barker et al in press), but in general terms, it is the responsibility of the subject specialist to ensure that the content of the material and built-in assessment satisfies the accreditation criteria for the award of National Vocational Qualification (NVQ), while the implementation of the material and the application of the pedagogical principles employed in its design is the responsibility of the project manager.

The requirement to provide a single piece of multimedia learning material suitable for students with a wide range of learning and physical disabilities presents many problems. Not least it must challenge the most able and yet be useful to all learners and deliver learning to those with severe learning difficulties. In order to achieve this, a set of guidelines regarding the design of multimedia learning materials was established for use in the implementation of the project (Barker et al in press). Central to these guidelines was the concept of individual configuration to a particular user's needs. Each user has a unique configuration file that is read when the user logs in by selecting their picture from a login screen. The contents of this file are used to set up the level of language used in the course presentation, the configuration of sound presentation (on, off, interruptable, repeatable), the availability of additional help tools, text and screen presentation and the types and level of task available within the course.

The use of task-based learning is central to the design of the course. To incorporate suitable tasks, we have found a simple presentation model which is able to challenge some users yet not discourage others. For each screen of information presented, there is an associated set of tasks, a set of questions and a review screen. In this way simple material may be presented which is suitable for all learners, and additional challenges for some learners may be imposed by the selection of higher level language in the presentation and by the use of higher level tasks.

As an example, we may consider the presentation of information about cleaning agents. In this case, the information is shown on one simple screen, and three levels of task are available for the user in relation to this information.
Tasks at different levels are defined in relation to Bloom's taxonomy of learning levels (Bloom 1956) in which the first three levels are:

Level 1 - Knowledge:	Fact recall with no real understanding
Level 2 - Comprehension:	Ability to grasp the meaning of material
Level 3 - Application:	Ability to use learned material in new situations.

Level 1 tasks thus involve simple reproduction of the knowledge presented, for example, identifying which of the displayed cleaning materials could be used to clean a floor. Greater challenge is required to perform level two tasks. Comprehension of the material is needed, involving translation, interpretation and extrapolation according to Bloom (1956). For example a level 2 task might be to select from a range of possible scenarios (presented on video), the likely consequences of some action such as leaving a spill not cleaned up. Level 3 tasks involve the application of knowledge to practical situations. For example the learner may have to decide how previously presented information might be applied to their own particular work situation.

Tasks are implemented in several ways within the application. Simple tasks may involve pointing and clicking (or touching the screen), dragging and dropping and similar computer mediated activities. More complex tasks often involve thinking time, group activities away from the computer and involvement of tutors and work supervisors. The design of tasks is in itself a challenging activity and requires a high degree of effort and skill from within the team.

5 Discussion

The materials described above are currently being used by people with learning disabilities in England, Spain and Ireland and feedback from initial evaluations has been very positive. It is intended to produce German, Danish, Italian and other language versions when evaluation of stage one of the project is complete.

The use of tasks in multimedia learning applications is in many ways no different from their use in good classroom teaching. In both cases, they may be used to support learning by reinforcing learner's knowledge and by providing challenges where knowledge can be applied and understanding tested. In multimedia applications tasks are essential because they can add interest to the presentation and add realism, simulation and application to the learning process. The use of tasks for learners with severe physical and learning problems is especially important as it allows us to provide a high degree of support for all learners following the core material, yet differentiate to provide challenges for those learners in a position to make use of them.

Future work will look at extending the levels and types of task available to the learner. In addition it will be important to increase the number of ways that learning material may be configured for the learner, perhaps on the basis of the individual learning style of the user.

The importance of individual learning style has been emphasised by several authors, (Kolb 1978, Riding 1991, Riding et al 1996, Entwistle 1992), and it seems likely that the learning experience people with learning disabilities could be substantially improved by understanding their individual learning styles.

Finally, it is also important that individual methods of user evaluation are designed for use in this work. We have found that individual configuration of computer-based applications for learners with severe learning problems presents real challenges, not only in design and development, but also
in the testing and evaluation of the material produced.

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